

Are the current EWA Chinook Decision Tree numeric criteria appropriate?

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In 2001, NOAA Fisheries and DFG made substantial changes to the way they calculated winter run Chinook juvenile production estimate (JPE), which raised the Delta Fish Facilities incidental take level from below 10,000 (1993-2000) to above 30,000 (2001-2003). This is a re-evaluation of the current numeric criteria used in the EWA Chinook decision tree to determine if they are still appropriate given the large change in the JPE. This analysis is on the numeric criteria used for Delta Cross Channel (DCC) gate closures and export curtailments at the Delta Fish Facilities.

Cross Channel Gate closure criteria

From October through January, in the current decision tree, if the standardized catch at Knights Landing, Sacramento trawl, or Sacramento Area beach seine is between three and five, the MAs consider a DCC gate closure. If the standardized catch is between five and ten the DCC gates are closed for four days within 24 hours. If the standardized catch is greater than ten the DCC gates are closed until the catch is less than five. At Knights Landing the calculated standardized catch is the number of older juvenile Chinook recovered in a one-trap day. In the Sacramento trawl the calculated standardized catch is the number of older juveniles recovered in ten tows and in the Sacramento area beach seine it is the number recovered in eight hauls.

In water years 1996 through 2004 fall pulse flows associated with precipitation events started in late November and continued throughout December, except in water years 2000 and 2001. In water years 2000 and 2001 the pulse flows associated with precipitation events were smaller, less frequent, and substantial changes in flow did not occur until mid January.

In the wetter years (1996-1999 and 2002-2004) the older juvenile Chinook catch in the Knights Landing rotary screw traps came in either one or two pulses during these early flow events (Figure 1). When the average flow remained above 13,000 (1999, 2002-2004), the older juvenile Chinook moved in one large pulse. That pulse accounted for 75% to 93% of the total older juvenile recoveries in each water year. In the other years the fish moved in two pulses, each preceded by flow events (Figure 1). The first pulse was the largest followed by the second pulse within eight days. The two pulses accounted for 43% to 73% of the total older juvenile catch in each water year. In all years each pulse started with standardized catch greater than five (Figure 1).

In the drier years (2000 and 2001) the Knights Landing older juvenile Chinook catch also came in pulses but the bulk of the recoveries came later in the year. In 2000 the total number of recoveries was less than fifty and most of the fish

(42%) were recovered in February (Figure 1). In late November there was a single day with a standardized catch greater than three followed by a small pulse in early December. These small recoveries accounted for 29% of the total juvenile catch. In 2001 the total older juvenile catch was closer to those from the wetter years but the first pulse was small, accounting for 9%, and did not occur until late December. Two larger pulses occurred in January and were similar to the wetter years with an initial standardized catch greater than five and they occurred within eight days of each other (Figure 1). Those two pulses accounted for 62% of the total older juvenile recoveries for the year.

The distribution was different in the Sacramento River trawl (Figure 2). In the wetter years (1996-1999 and 2002-2004) there was a distinct pulse of older juvenile Chinook in November/December and a second pulse in February/March. The first pulse was usually larger than the second pulse. The first pulse accounted for 28 to 71% while the second pulse accounted for 11 to 57% of the total juvenile catch within each water year. The first pulse was more defined than the second pulse but both started with a standardized catch greater than or equal to five (Figure 2).

In the drier years (2000-2001), catch of older juvenile Chinook was low and intermittent between October and December. Standardized catches greater than or equal to three started in mid-January and the catch peaked in February in both years (Figure 2). The recoveries in mid-January accounted for approximately eight to ten percent of the total recoveries for the year.

The catch of older juvenile Chinook in the Sacramento area beach seine was closely associated with catch in the Sacramento River trawl but in larger numbers (Figure 2). In all years the pulses were initiated by a standardized catch greater than or equal to five. In the wetter years the initial pulse occurred in either November or December while in the drier years it did not occur until mid-January (Figure 2).

Based on the re-evaluation, to protect migrating juveniles in drier years the MA's reduced the criteria to close the DCC. The new criteria are 1) close the DCC gates for four days within 24 hours, if the standardized catch at Knights Landing, the Sacramento trawl, or in the Sacramento area beach seine is between three and five, 2) close the DCC gates until the standardized catch is less than three if the catch is greater than five. In wetter years the initial pulses always began with a catch greater than or equal to five so no extra days of closures would have been necessary under the new criteria. In drier years there would have been approximately eight to twelve extra days of closures, based on the data from 2000 and 2001, under the new criteria.

SWP/CVP Export cuts criteria

The current Chinook criteria for export cuts, from October to May, are based on the daily older juvenile loss density at the Delta Fish Facilities. The loss density is the loss divided by the exports (taf). If the combined loss density of older juvenile Chinook is between eight and fifteen exports are cut to 6,000cfs at SWP or 3,000cfs at CVP for three days. If the Chinook density is greater than fifteen exports are cut to 4,000cfs at SWP or 2,000cfs at CVP for three days. The export cuts are taken at the Fish Facility that has the greatest loss. The export curtailment criteria are used as a means to manage incidental take to stay within the incidental take level for each season.

In most water years, from 1993 through 2004, there have been two peaks in older juvenile Chinook loss with one in the winter followed by a second peak in the spring. Since 1999 the spring peak has been larger than the winter peak, except in 2002. So, for this analysis the criteria were divided into two periods, the winter period from November to mid-February and the spring period from mid-February to mid-April.

In the winter period the average older juvenile loss was 2509, of that loss approximately 71% fell into the winter run length range (Table 1). On average, 54% of the total older juvenile loss for the season which runs from October to May occurred during this period (Table 1). The average loss density ranged from 0.2 to 2.6 and the maximum daily loss density ranged from 3.5 to 21.4 (Table 1).

During this period both spring run yearlings and winter run Chinook are emigrating through the delta and are susceptible to entrainment at the Delta Fish Facilities. While spring run escapement has been increasing in recent years the numbers are still low and the loss of older juveniles during this period can be a substantial proportion of the total loss in each season (Chappell, 2003). Based on this analysis the MA's slightly modified the criteria the between October and mid-February. The new criteria are 1) reduce exports to 4,000cfs at SWP or 2,000 at CVP if the combined loss density is greater than five when the winter run incidental take level is less than 10,000, 2) use original criteria, to protect spring run juveniles, when the winter run incidental take level is greater than 10,000.

In the spring period the average loss was 3433, ranging from 113 to 18,319 (Table 2). During this period all of the older juvenile Chinook fall into the winter run length range. The average daily loss density ranged from 0.2 to 20 and the maximum daily loss density ranged from 3.5 to 104 (Table 2).

For the spring period the analysis is on determining the average daily loss density at which the winter run incidental take level would be reached. The incidental take level is the loss of 2% of the winter run juvenile production estimate (JPE) in each given season (October-May). The daily density at which the incidental take level is reached is simply the 2% JPE divided by the total exports during the spring period. This is the "critical density". Historically, the

“critical density” is on the average, about 1/1000 of the 2% JPE, therefore an adequate approximation of the “critical density” is the 2% JPE/1000. To verify if the incidental take level would have been reached the daily loss was calculated by multiplying the “critical density” (2%JPE/1000) by the actual daily exports. These daily values were then summed to calculate the total loss for the season (Table 2). This was done using the JPE’s calculated from both the Red Bluff Diversion Dam (RBDD) counts for water years 1993 through 2004 and the carcass survey estimates for water years 1999 through 2004. In years where the average daily exports were below 16taf the incidental take level was not exceeded but when the average daily exports were above 16taf the incidental take level was exceeded (Table 2).

Since the incidental take level was exceeded in years with higher average exports using the “critical density” for the deepest cut of SWP to 4,000cfs or CVP to 2,000cfs would be appropriate, except in years where the incidental take level is less than 5,000. For example, in 1994 the incidental take level, using the RBDD counts, was 1810 so the loss density to trigger the deepest cut would only be 1.8 (Table 2). In those years a loss density of 2.5 usually preceded a pulse in older juvenile Chinook loss and the estimated season loss, calculated using a daily density of 2.5, remained below the incidental take level (Figure 3 and Table 2). In addition, the smaller cut would be appropriate at a density equal to 2% JPE/2000 in years where the incidental take is greater than 5,000 but is not necessary in years where the incidental take is less than 5,000. The 2% JPE/2000 is the density at which a loss of 1% of the JPE would occur and is also the current warning level.

The final step in the analysis was to assess how the new criteria would change the use of EWA water between January and March. The new criteria were applied to water years 2001 through 2004 using the JPE from the carcass survey to determine where EWA assets would have been used (Figures 3-6).

In 2001 SWP exports were cut to 4,000cfs in mid-February when the loss density exceeded 15, using ~59taf of EWA assets. A second deeper cut was taken between late February and mid-March due to continued loss, using ~126taf of EWA assets (Figure 3). Under the new criteria the DAT biologist would have recommended a smaller cut to 6,000cfs in mid-February. However the SWP exports were being held at 6,000cfs for water quality purposes so a cut using EWA assets would not have been necessary. The DAT biologists would have recommended the second cut as well, however it would have started later and lasted longer, using ~103taf (Figure 3). Therefore, the new criteria, with hindsight, would have saved an extra 5200 older juvenile Chinook using 103taf compared to 185taf of EWA assets (Figure 3).

In water year 2002, no EWA actions were taken specifically for the protection of older juvenile Chinook and none would have been recommended under the new criteria (Figure 4). In early March the density of older juvenile Chinook did

exceed 8 which could trigger an export curtailment under the current criteria; however SWP exports were already below 6,000cfs so an EWA action was not taken.

In water year 2003, an EWA action was taken in early January for the protection of older juvenile Chinook and delta smelt. This action would also be recommended under the new criteria (Figure 5). No other actions were taken specifically for older juvenile Chinook. Under the current criteria a second action was considered in early March when the loss density exceeded 15 but the loss was well below the incidental take level so DAT biologists did not recommend an action. If an action had been taken it would have saved ~ 175 older juvenile Chinook using 12taf (Figure 5). This action would not have been triggered under the new criteria.

In water year 2004 no EWA actions were taken for the protection of older juvenile Chinook and loss remained well below the incidental take level. Under the current criteria two actions were considered, one in late February and one in early March when loss densities exceeded 15 (Figure 6). Those actions, had they been taken, would have saved ~940 older juvenile Chinook using 63taf of EWA assets. Under the new criteria an action would have been recommended in late February based on the loss density, but it would have been a smaller cut using 18taf of EWA assets to save ~300 older juvenile Chinook (Figure 6).

Therefore, based on this analysis the MA's changed the criteria between mid-February and May. The new criteria are 1) reduce exports to 4,000cfs at SWP or 2,000 at CVP when the loss density is greater than 2.5 if the incidental take level is less than or equal to 5,000, 2) reduce exports to 6,000cfs at SWP or 3,000cfs at CVP if the daily loss density is greater than to 2% JPE/2000 when the take level is greater than 5,000, 3) reduce exports to 4,000cfs at SWP or 2,000cfs at CVP if the daily loss density is greater than 2% JPE/1000 when the incidental take level is greater then 5,000. These changes enable the MA's to protect all Chinook of concern, meet ESA assurances, and maximize the use of limited EWA assets.